



Open Architecture / FORCEnet Experimentation Initiative



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Vision

- Navy Enterprise Open Architecture Objectives:
 - Develop the best of the best warfighting capabilities
 - ➔ **Quicker and affordable**
 - Seamless OA/FORCEnet Integration
 - ➔ **Reducing the risk of delivering non-interoperable products**

**Engineering Agility thru Experimentation Strategy
Directly supports the Navy Enterprise OA
Transformational Roadmap**



Why Open Architecture?

Business

- Today's In-Service Computing Architectures are Unaffordable
- Each Ship Class Addressing the Problem Uniquely
- Fact of Life Replacement of Obsolete Hardware
- Commercial Market has Already Embraced Open Architecture Approach

Technical

- Current Computing Architectures Limit Capability Increases
 - Current Surface Ship Computing Systems Have Been at Performance Capacity for Years
- Warfighting Concepts to Warfighting Capability Takes 5 Years to IOC
- Computer Throughput and Speed Requirements Dictate use of Commercial Computing Technologies and Modern Software Languages

Improved Warfighting Capability Depends on Open Architecture



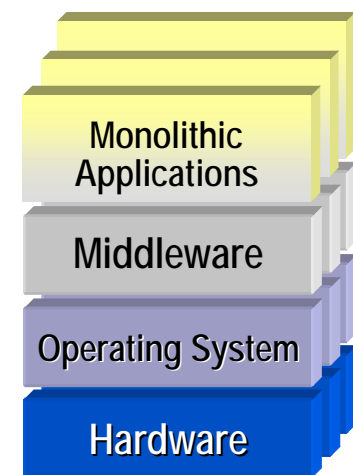
Evolutionary States of OA in Programs

Surface Domain OA Definition

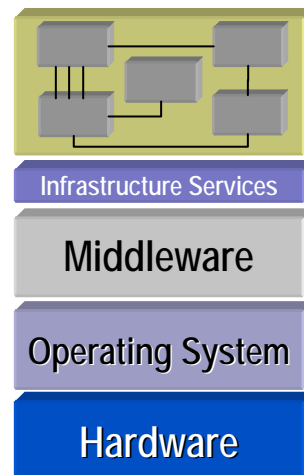
Non-OA	Category 3	Category 4 Open	Category 4 Common	Category 4 Enterprise
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Enterprise Definition

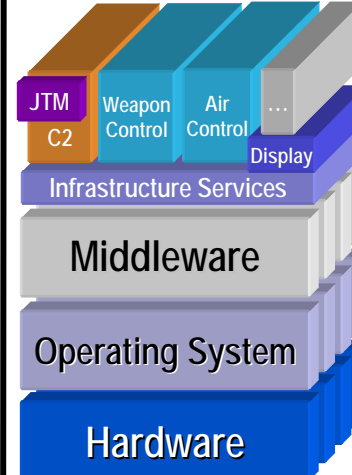
"Closed"	"Layered"	"Layered & Open"	"Common"	"Enterprise / Joint"
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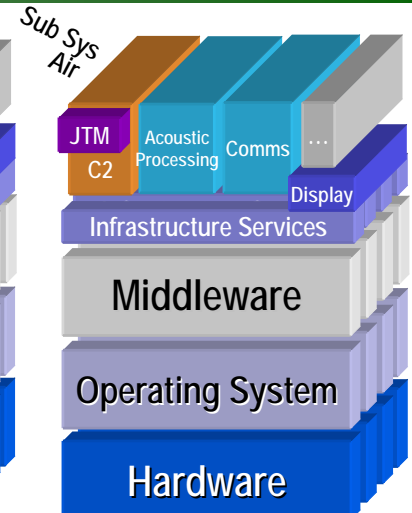
- ◆ "Unglue the Stack"
- ◆ H/W & Software Isolation



- ◆ Modular Applications
- ◆ Opens Up Vendor Base
- ◆ Platform Arch CCB



- ◆ Cross-Program Apps
- ◆ Mixed Developer Base
- ◆ Domain Arch CCB



- ◆ Cross-Domain Apps
- ◆ Mixed Developer Base
- ◆ Enterprise/Joint Arch CCB

OA RETURNS

- ◆ COTS Refresh Cost Avoidance

- ◆ Ease of Warfighting Upgrades
- ◆ Enables Competition

- ◆ Reduce Development & Maintenance Costs

- ◆ Reduce Development
- ◆ Enables Interoperability

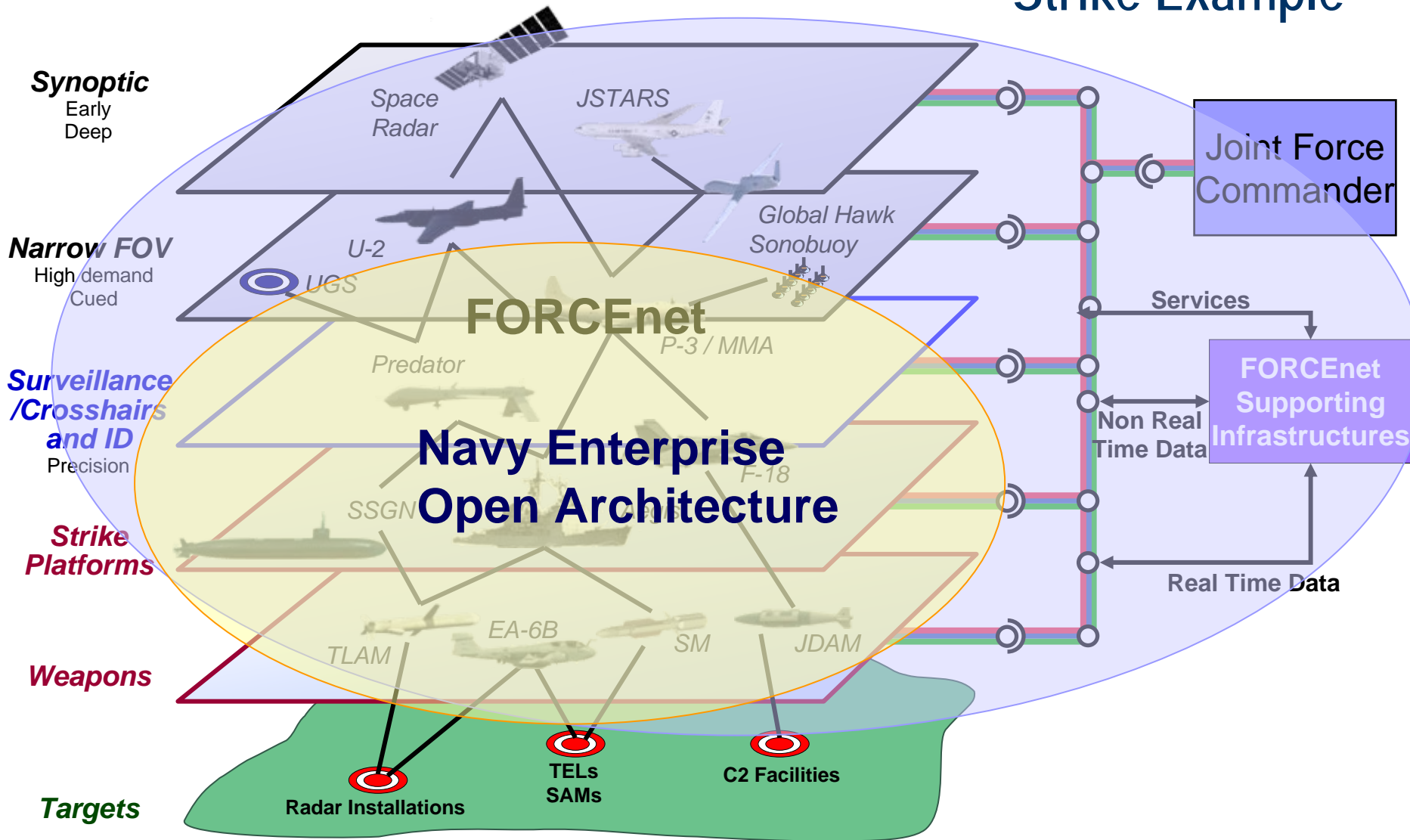
Program Manager Control

Cross-PM Coordination Required

Operational Context View



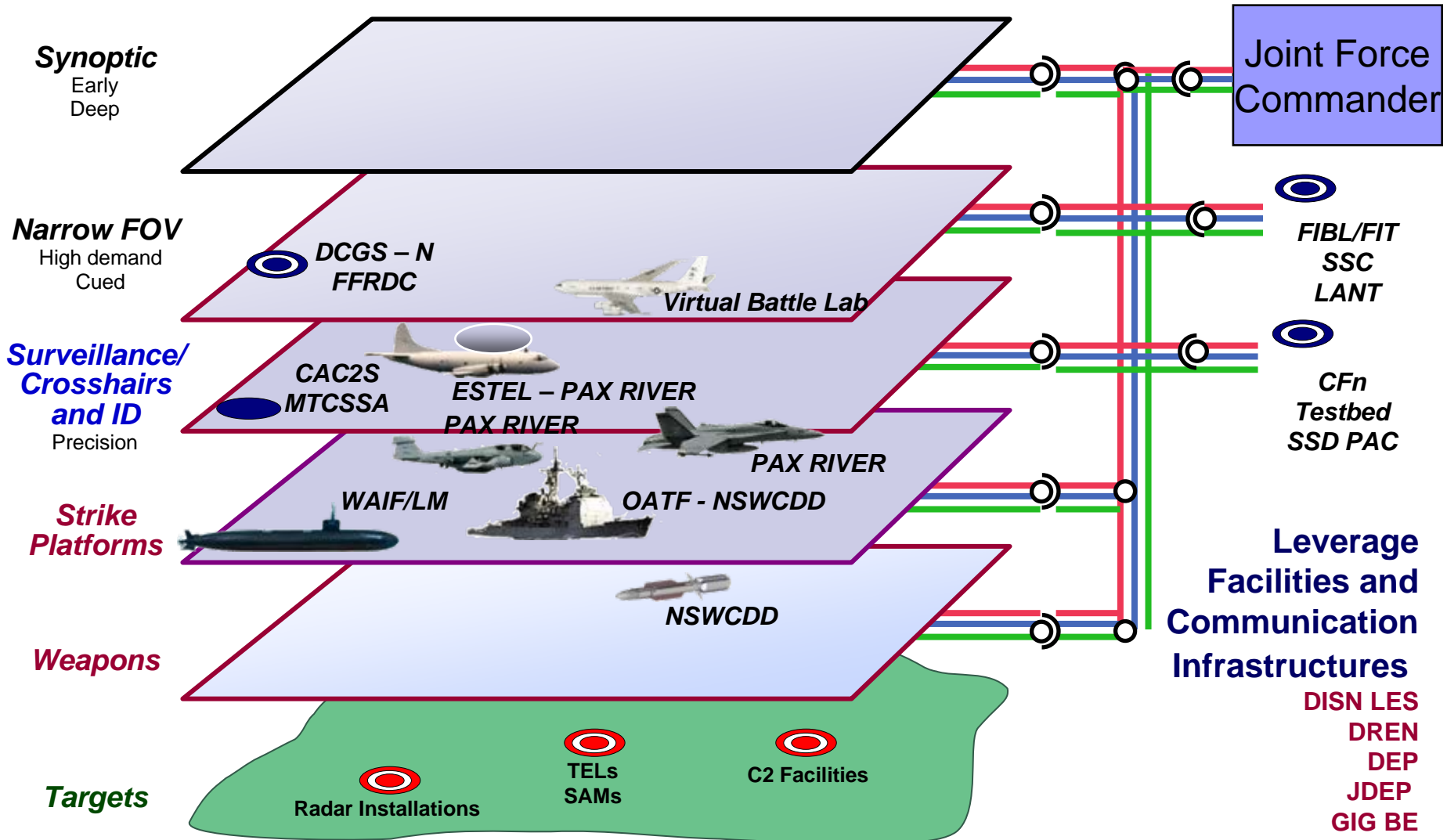
The Net-Centric Lattice Strike Example



Land-based Test Sites Connectivity View



The Net-Centric Lattice Strike Example



Engineering Agility and Efficiency



Implementation of Specification and Standards don't guarantee desired performance and interoperability for overall System of Systems

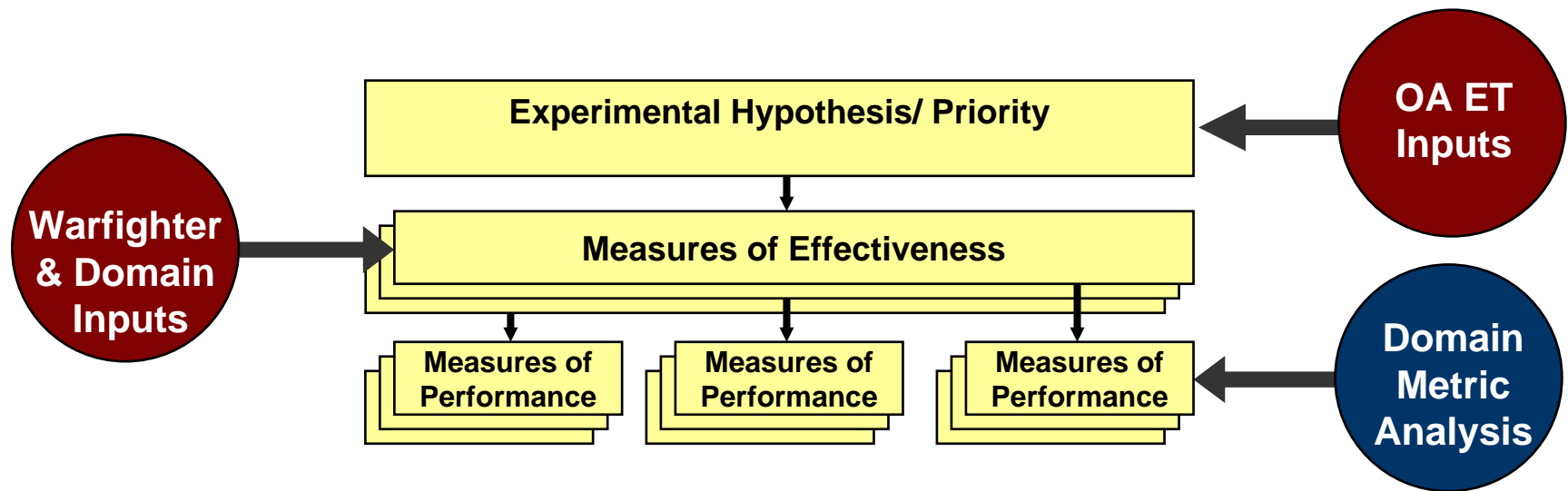
- Path for increasing agility and efficiency
 - Accelerate and refine established architectures, design, development processes across enterprise
 - Provide flexibility to enable efficient assessment of enterprise level engineering issues
 - Embed measurement tools for early monitoring, testing, and evaluation
 - Support a culture of OA/Fn innovation and experimentation

Agility

Traditional acquisition	Incremental Improvements	Experimentation during Design and Integration
Procure-use-procure	Build-test-build	Build-assess-Build
3+ years	6-18 months	1-6 months
Tools for the last war	Example: ARCI (Acoustic Rapid COTS Installation) program	Adapt Design processes to address architecture & designs issues early



Methodology for Measuring OA/FN Experimentation



Integrated Product Team Deliverables:

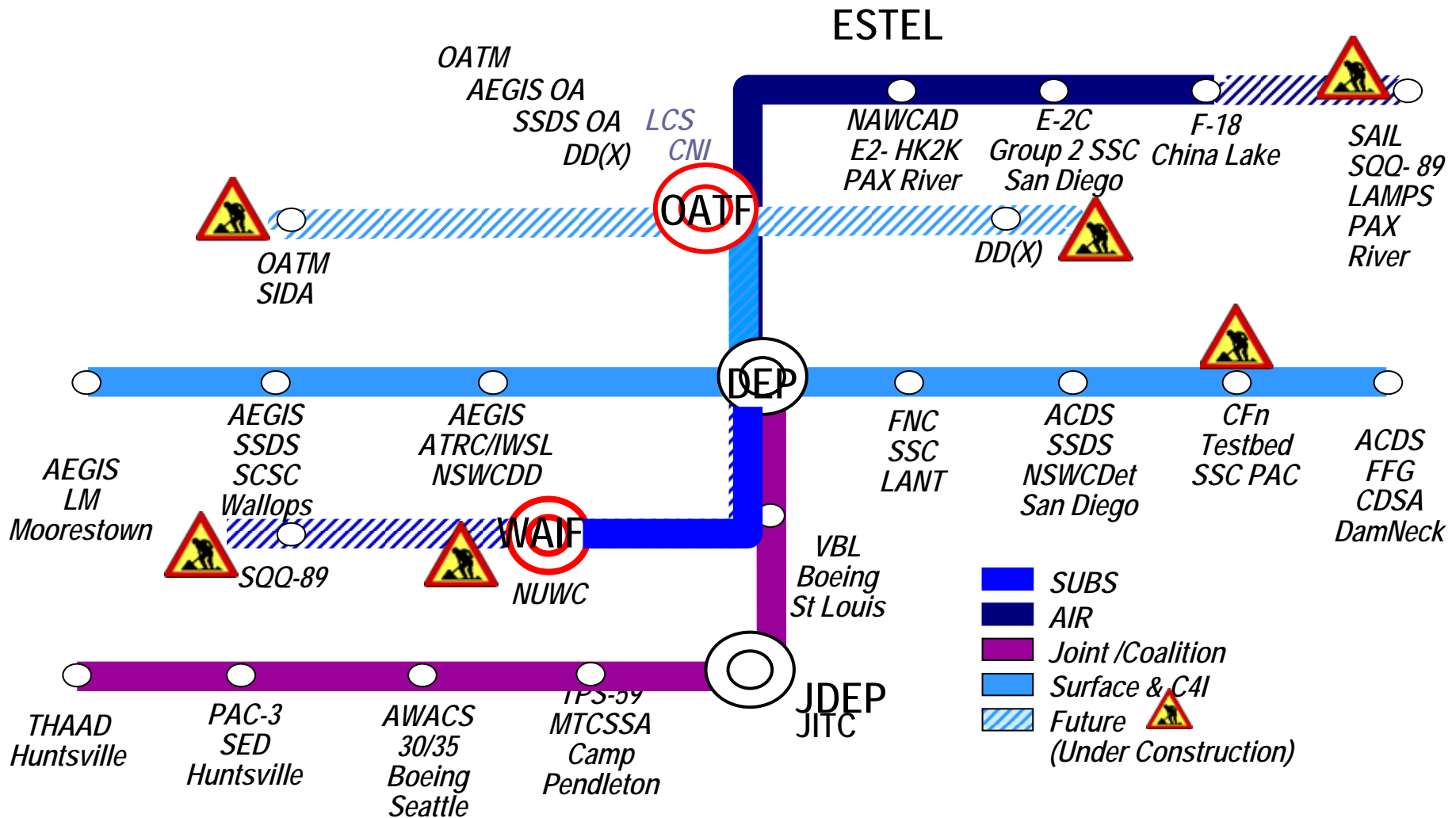
1. Prioritized Engineering Assessment Candidate Topics List
2. OA/FN Engineering Assessment(s)
 - Event X Assessment Plan
 - Event X Assessment Results
 - Event X Demonstration

OA/FN Alignment Experimentation Objectives



- ❑ End to End Force Level System Engineering
 - ➔ Experimentation to resolve issues that needed to be solved
- ❑ Testing Reusable Component Effects across systems and domains
- ❑ Foster Team work and common understanding across domains
- ❑ Use Open/Collaborative Engineering Environment across Navy Enterprise
 - I. Leverage existing Netted environments of Land based Test Sites and Live Assets (Via Sea Trial Process) where applicable
 - II. Data Repository/Tools – Enterprise Level Engineering Assessment Capability

OA Enterprise Engineering Nodes View



Connect Government & Industry Engineering Nodes

Tasks/Team Formation



Participants:

PEOs C4I, Subs, IWS, T,Space,
RDA CHENG, FN CHENG,
NAVSEA 06, MARCORSYSCOM,
IAT, MIT/LL, industry

Project Coordination

- Overall Project Management Activities
- Cross Domain/Activities Coordination

Concept Development

- Choose high level concepts to test capabilities
- Assess relevancy to warfighter, high-level feasibility
- Develop linkages/resources
- Set experimentation roadmap

Infrastructure

- Provide network and services
- Engineering level testing
- Manage components
- Modeling / Simulation

Reporting

- Manage reporting process
- Organize MUA
- Review analysis products

Experiment Design

Experiment Execution

Experiment Analysis

- Experiment Architecture
- CONOPS/Scenario supporting metrics
- Requirements input (SME/warfighters)
- Metrics (MOP/MOE)
- Data Collection and Analysis Plan (DCAP)

- Experiment infrastructure
- Data collection/observation
- Experiment integration
- Experiment control

- Archive data
- Metric analysis
- Results and recommendations

Experiment Teams focus on individual experiments

Core Teams

Experimentation Process



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Phase One: Concept Development

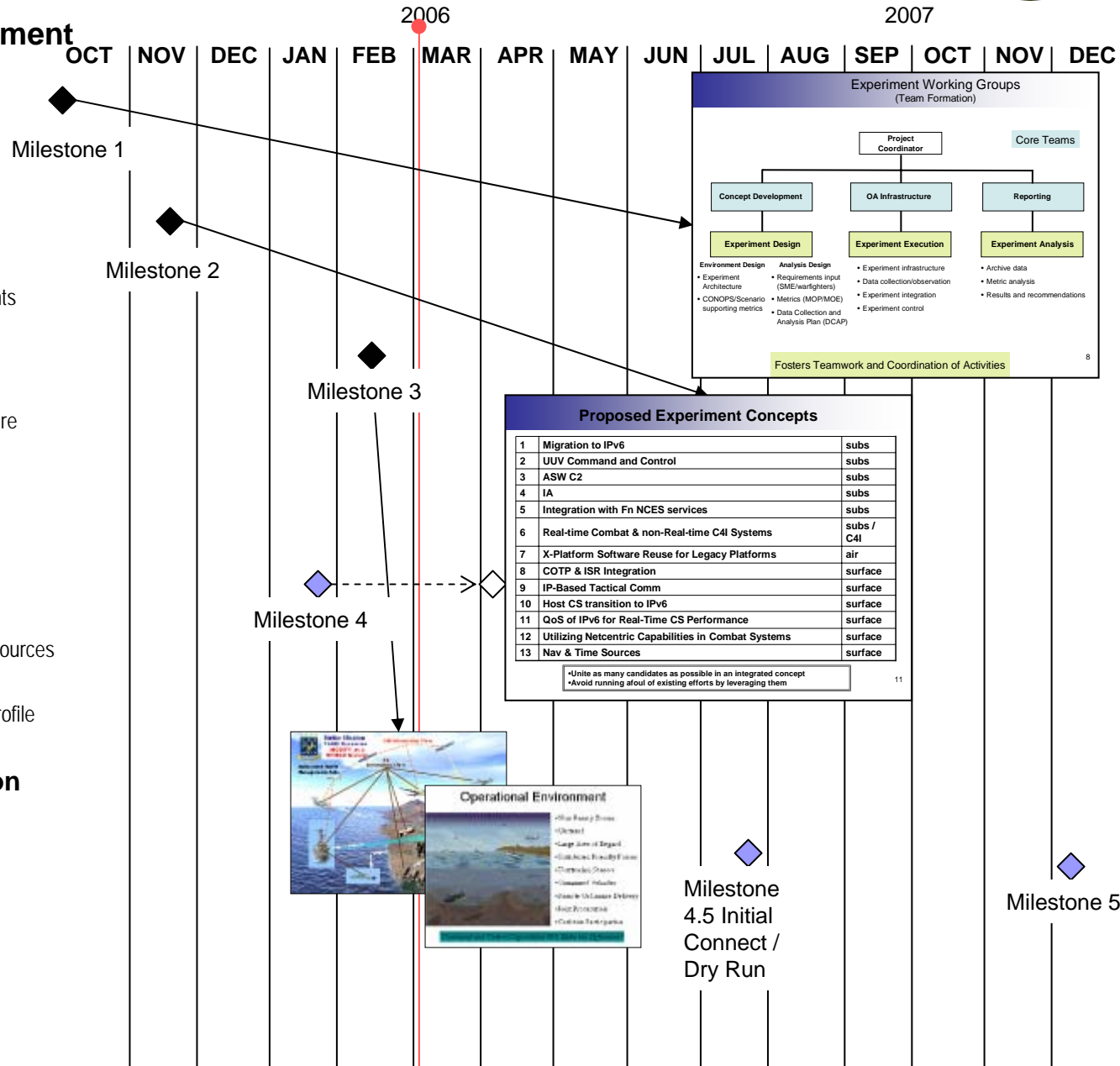
- Team Formation
 - ✓ Define selection process/Criteria
 - ✓ Define Roadmap Template
 - ✓ Define Proposal Template
- Data Call
 - ✓ Elicit Proposals from Domains
 - ✓ Consolidate List of Candidate Ideas
 - ✓ Ideas Rollup into Candidate Experiments
 - ✓ Domain Agreement
- Focused Concept Data Call
 - ✓ Elicit Experiment Proposals
 - ✓ Define/ Distribute Concept Questionnaire
 - ✓ Consolidate Candidate Concepts
 - ✓ Assess Options
 - ✓ Analyze Proposals Domain Agreement

Phase Two: Experiment Design

- Specific Experiment Decision
 - Prepare Experiment Design
 - Determine Availability of Labs and Resources
 - Build Final Roadmap
 - Determine Experimentation Funding Profile
 - Domain Agreement

Phase Three: Experiment Execution

- Experiment Execution
 - Establish Experiment Execution Team
 - Build Program Management Plan
 - OAET Approval of Schedule and ROM
 - Design Experiment Execution Plan
 - Approval for Execution Plan
 - Experiment Execution
 - Experiment Analysis
 - Experiment Report





Is it OA?

Architecture and Technical Characteristics

Interoperability

- With what interoperability standard does the unit of assessment comply?
- How standards based is the unit of assessments data model?
- What is the scope of the data model
- What is the scope of interoperability
- To what extent does it use discovery and invocation of services (client/server)

Maintainability

- What characteristics address obsolescence
- Do technical artifacts provide sufficient quality for maintenance

Extensibility

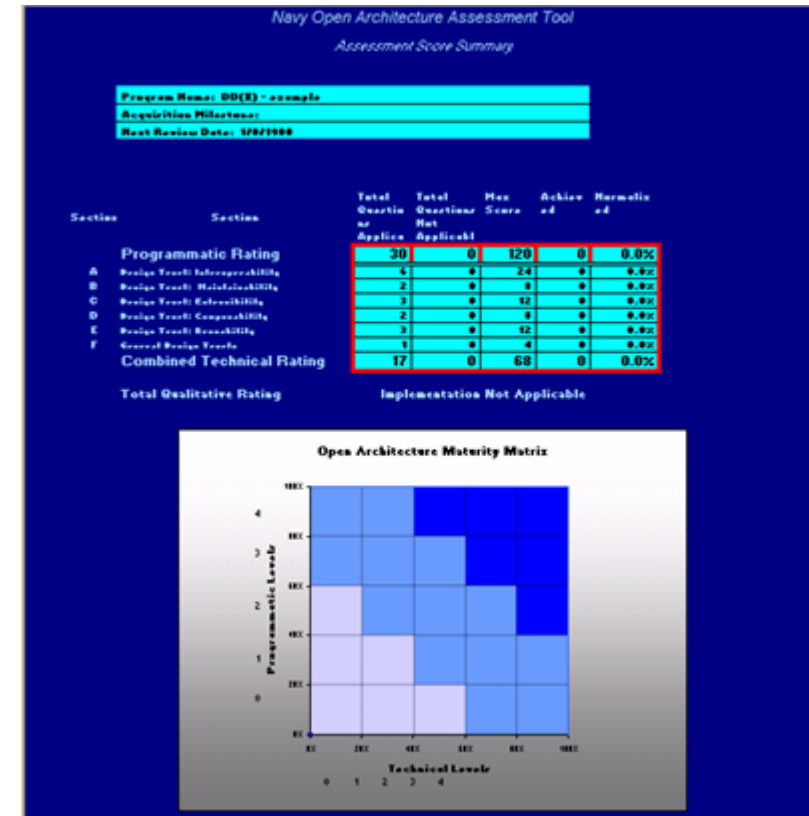
- Does the program follow SE for implementation of capability extension
- Does it accommodate extensibility of functionality
- Describe level of testing after elements are added

Composability

- To what extent are elements added as packages
- To what extent can functional capabilities be combined

Reusability

- What reuse strategy is used
- What is the operational run-time infrastructure
- Have commonalities and variations been specified



Business and Acquisition Characteristics

Competition ...

Innovation

Is it FORCEnet?



FORCEnet Concept Capabilities



★ Mission ★ People ★ Capability

1. Provide robust, reliable communication to all nodes, based on the varying information requirements and capabilities of those nodes.
2. Provide reliable, accurate and timely location, identity and status information on all friendly forces, units, activities and entities/individuals.
3. Provide reliable, accurate and timely location, identification, tracking and engagement information on environmental, neutral and hostile elements, activities, events, sites, platforms, and individuals.
4. Store, catalogue and retrieve all information produced by any node on the network in a comprehensive, standard repository so that the information is readily accessible to all nodes and compatible with the forms required by any nodes, within security restrictions.
5. Process, sort, analyze, evaluate, and synthesize large amounts of disparate information while still providing direct access to raw data as required.

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FORCEnet Concept Capabilities



★ Mission ★ People ★ Capability

6. Provide each decision maker the ability to depict situational information in a tailorable, user-defined, shareable, primarily visual representation.
7. Provide distributed groups of decision makers the ability to cooperate in the performance of common command and control activities by means of a collaborative work environment.
8. Automate lower-order command and control sub-processes and to use intelligent agents and automated decision aids to assist people in performing higher-order subprocesses, such as gaining situational awareness and devising concepts of operations.
9. Provide information assurance.
10. Function in multiple security domains and multiple security levels within a domain, and manage access dynamically.

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FORCEnet Concept Capabilities



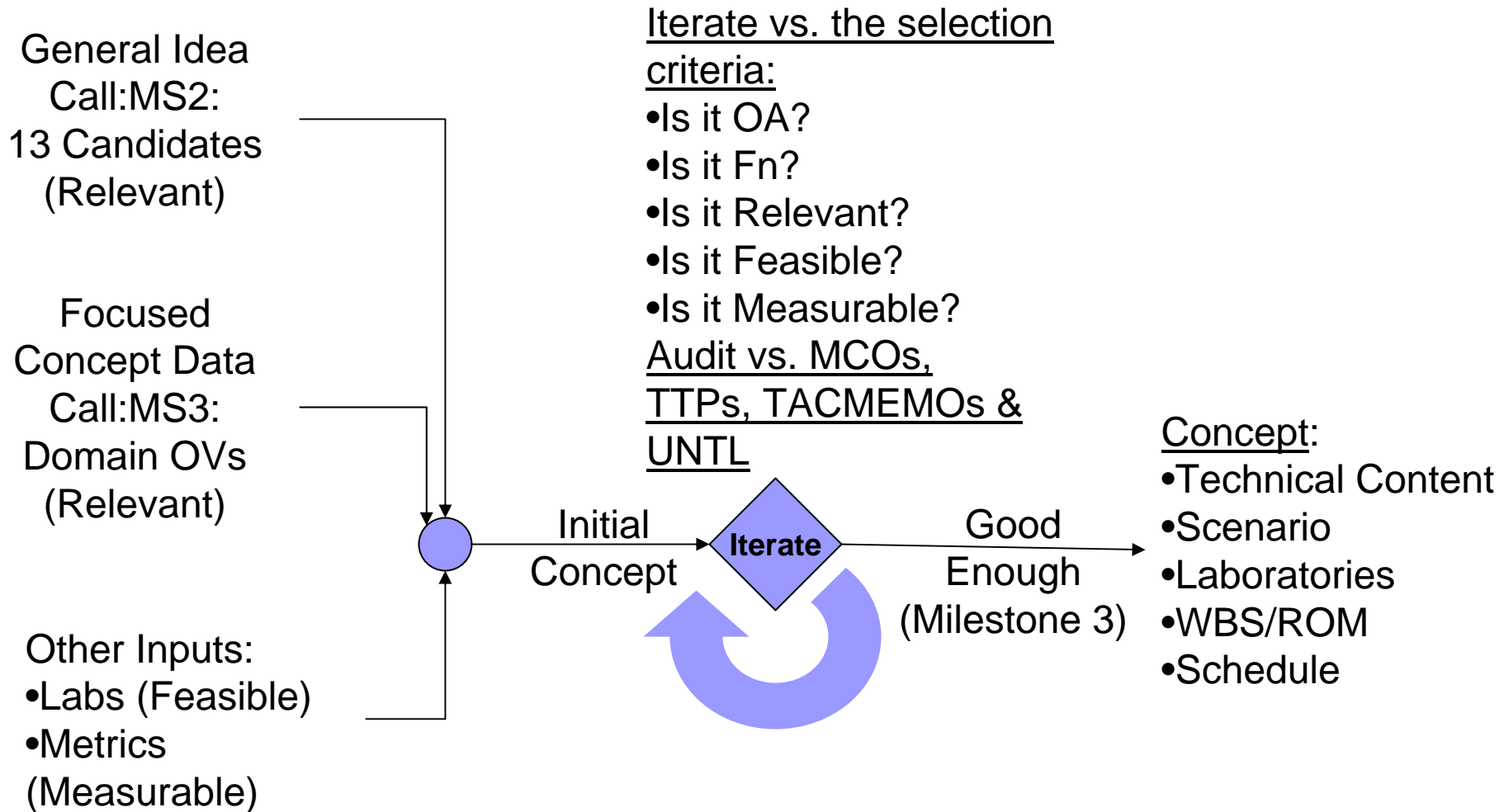
★ Mission ★ People ★ Capability

11. Interoperate with command and control systems of very different type and level of sophistication.
12. Allow individual nodes to function while temporarily disconnected from the network.
13. Automatically and adaptively monitor and manage the functioning of the command and control system to ensure effective and efficient operation and to diagnose problems and make repairs as needed.
14. Incorporate new capabilities into the system quickly without causing undue disruption to the performance of the system.
15. Provide decision makers the ability to make and implement good decisions quickly under conditions of uncertainty, friction, time, pressure, and other stresses.

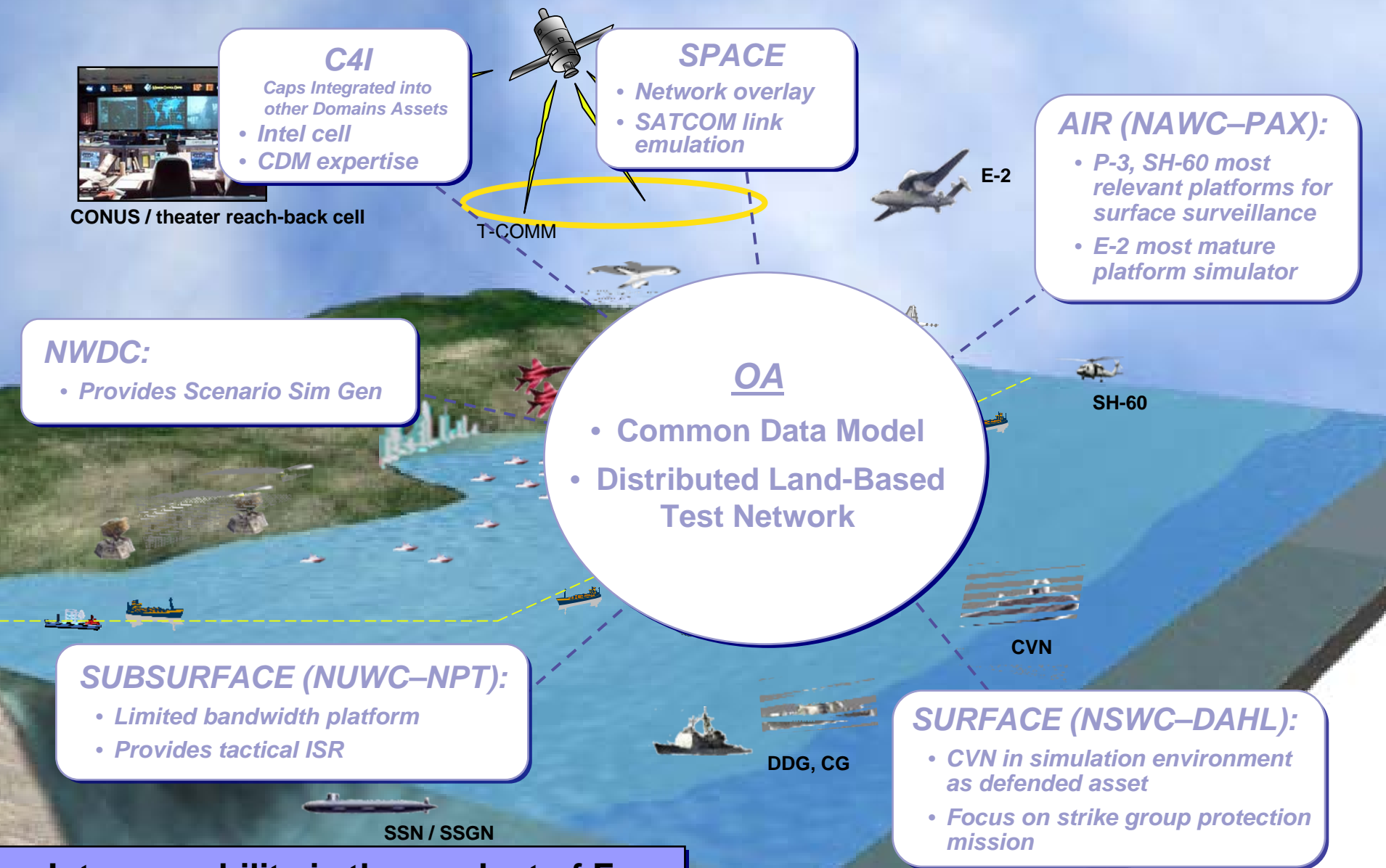
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Concept Development Process



DOMAIN ROLES & FACILITIES



Interoperability is the product of Fn standards and OA business practices

OA Experiment 06 Overarching Goals



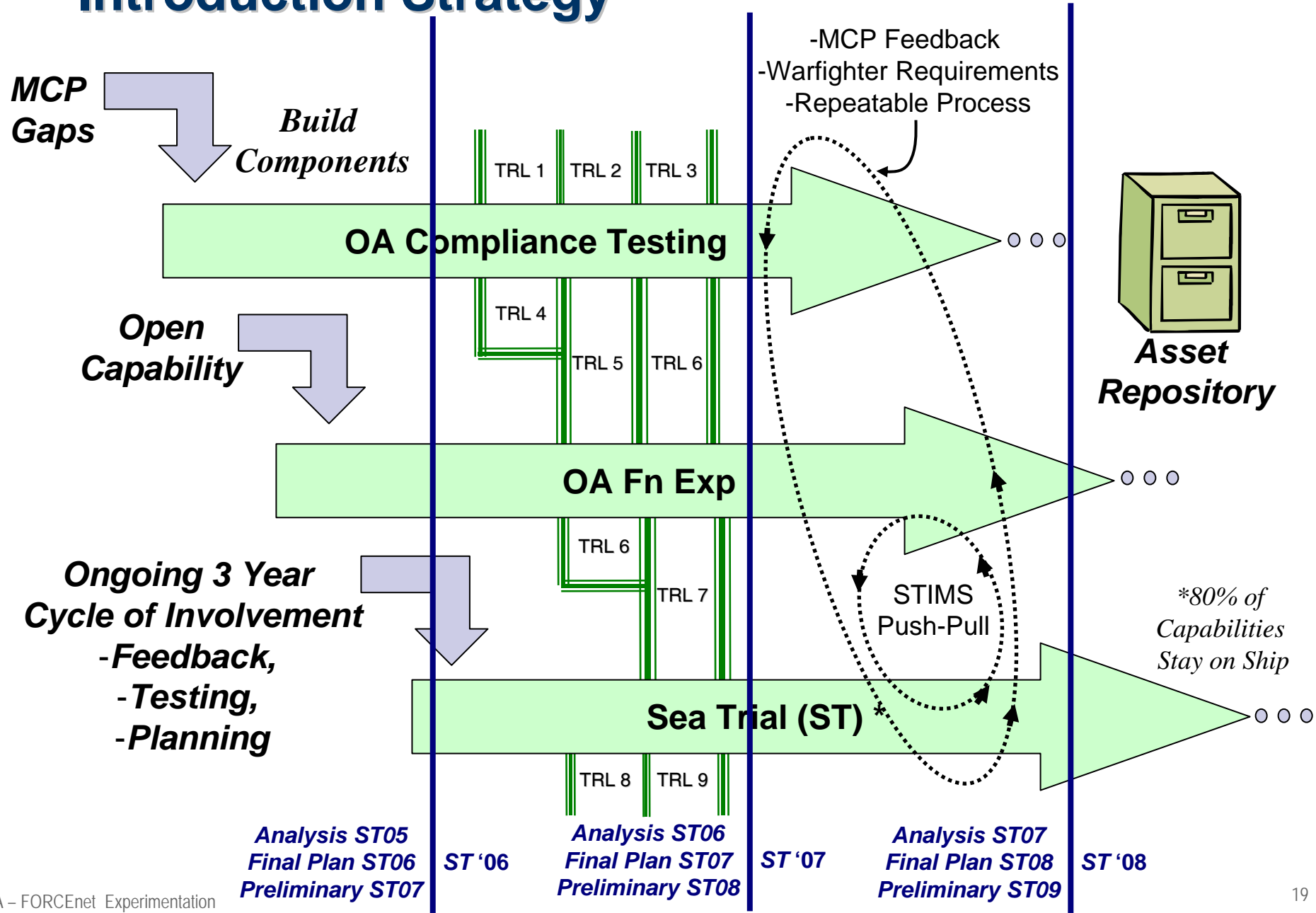
Objective: Quantify impact of data semantic alignment (e.g. a Common Data Model) on architectural and business process

- Key characteristics:
 - Measure the effects of a Common Data Model (CDM)
 - Study a developmental CDM
 - Use a distributed simulation in a constructive operational environment
- Complementary goals of OA Experiment 06-1:
 - Operational value of a CDM solution support for:
 - Combat ID, Situation Awareness, Data Fusion, Track Management
 - Substantiate the business case (savings/benefits)
 - Provide feedback to Systems developer to improve cross-domain interoperability
 - Archive processes and lessons in the Navy Collaborative Engineering Environment
 - Leave behind improvements to the distributed land-based test network

06 Experiment Planning & Execution Schedule



Rapid Capability Insertion Process Test & Introduction Strategy





Summary

- This OA/FN Experimentation Initiative will provide:
 - An Enterprise collaboration environment and process for assessment and evaluation of
 - OA Technical and Business precepts where applicable
 - Potential reuse components that will be shared in the Navy and across the Joint community in a distributed and network centric environment
 - Some level of Architecture Alignment and Validation of Standards Implementation (OACE, NCOW, Fn, IA...)
 - Foster Team work and collaboration across the Enterprise to enable
 - Closer coordination for engineering and acquisition decisions
 - Alignment of efforts and schedules to capture best investment opportunity